CLAIMS

1. (Original) A method of embedding a watermark signal comprising a series of watermark values in a picture signal comprising a series of picture sample values, the method comprising adjusting picture sample values based on watermark values, characterised in that adjusting comprises, for each watermark value:

combining the watermark value with a respective subset of the picture sample values using a plurality of adjustment factors, each adjustment factor being based on a local estimate of the visibility of the watermark at a corresponding picture sample location.

2. (Original): A method according to Claim 1, wherein the magnitude of each adjustment factor is a function of the picture sample values, preferably based on the localised variance of the picture sample values.

3. (Currently amended) A method according to Claim 1 ~~or Claim 2~~, wherein the sign of each adjustment factor is a function of the watermark values.

4. (Currently amended) A method according to <u>Claim 1</u> ~~any preceding claim~~, wherein combining comprises adding an adjustment factor to each picture sample value.

5. (Currently amended) A method according to <u>Claim 1,</u> ~~any preceding claim~~ wherein the picture sample locations for each said subset corresponding to a given watermark value are substantially adjacent.

6. (Original) A method according to Claim 5, wherein a grid dividing the picture into a plurality of regions is defined and wherein each said subset comprises picture samples corresponding to a respective region of the grid.

7. (Original) A method according to Claim 6, wherein the grid is substantially rectangular.

8. (Original) A method according to Claim 7 wherein each region corresponds to a block of a coding process, for example MPEG or JPEG compression.

9. (Currently amended) A method according to Claim 1, ~~any preceding claim~~ wherein watermark values are assigned to substantially all of said regions of the picture.

10. (Currently amended) A method according to Claim 1, ~~any of Claims 1 to 8~~ wherein watermark values are assigned to a first group of said regions and sample values of a data sequence are assigned to a second group of said regions.

11. (Currently amended) A method according to Claim 1 ~~any of Claims 1 to 4~~, wherein the picture sample locations for each subset are scattered throughout the picture.

12. (Currently amended) A method according to Claim 1, ~~any preceding claim~~ wherein the watermark signal comprises a pseudo-random sequence.

13. (Currently amended) A method according to <u>Claim 1</u> ~~any preceding claim~~ wherein the watermark signal comprises a regular pattern.

14. (Currently amended) A method according to <u>Claim 1,</u> ~~any preceding claim,~~ wherein the watermark signal has a substantially zero mean whereby the global mean of the picture sample values in the picture is substantially unaffected by embedding of the watermark.

15. (Currently amended) A method according to <u>Claim 1,</u> ~~any preceding claim~~ wherein combining is arranged to change the local mean of the picture sample values included in each said subset, the sign of the change being determined by the corresponding watermark value.

16. (Currently amended) A method according to <u>Claim 1,</u> ~~any preceding claim,~~ wherein each subset contains at least 16 picture sample values.

17. (Currently amended) A method according to <u>Claim 1</u> ~~any preceding claim~~ wherein the adjustment factors are a function of a global modulation index variable whereby the energy of the watermark can be controlled.

18. (Currently amended) A method according to <u>Claim 1,</u> ~~any preceding claim~~ wherein said adjustment factors are assigned a value substantially equal to zero for regions having a measure of variance below a predetermined threshold.

19. (Currently amended) A method according to Claim 1, ~~any preceding claim~~ for embedding a watermark in a sequence of pictures corresponding to a motion video sequence, wherein the subsets to which watermark values are applied vary from picture to picture.

20. (Original) A method of embedding a watermark within a sequence of pictures corresponding to a motion video sequence wherein the watermark is combined with picture sample values characterised in that the method of combining varies from picture to picture to reduce the appearance of static artifacts in the sequence.

21. (Currently amended) A method according to Claim 1, ~~any preceding claim~~ for embedding a watermark in a sequence of pictures corresponding to a motion video sequence, wherein applying the watermark to the sequence of pictures includes compensating for motion between pictures.

22. (Original) A method according to Claim 21, wherein motion compensation includes estimating average motion between pictures.

23. (Original) A method according to Claim 22, wherein applying the watermark includes determining at least a local measure of accuracy of the estimate of average motion.

24. (Original) A method according to Claim 23, wherein the watermark is applied so as to be reduced in visibility in areas of the picture (in the case of a local

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measure of accuracy) or in pictures (in the case of a global measure of accuracy) where said measure indicates that said estimate is inaccurate.

25. (Currently amended) A method of embedding a watermark within a sequence of pictures corresponding to a motion video sequence, ~~preferably according to any preceding claim~~, wherein the watermark is combined with picture sample values characterised in that the method of combining includes generating a motion-compensated version of the watermark to reduce the appearance of static artifacts in the sequence.

26. (Currently amended) A method of embedding a watermark within a sequence of pictures corresponding to a motion video sequence, ~~preferably according to any preceding claim~~, wherein the watermark is combined with picture sample values characterised in that the method of combining includes estimating average motion between the pictures and combining the watermark to reduce the appearance of static artifacts in the sequence.

27. (Original) A method according to Claim 26, wherein a measure of the accuracy of said estimate is determined and the strength of the watermark is varied as a function of said measure.

28. (Currently amended) A method according to <u>Claim 20,</u> ~~any of Claims 19 to 27~~, wherein the watermark is embedded in some but not all pictures of the sequence, preferably wherein at most one in two pictures are watermarked.

29. (Currently amended) A method according to <u>Claim 20,</u> <s>any of Claims 19 to 28</s>, wherein the pattern of picture sample values with which watermark values are combined varies from picture to picture.

30. (Original) A method according to Claim 29, wherein embedding the watermark includes defining a grid dividing the picture into regions and wherein at least one characteristic of the grid, for example shape, size or alignment, is varied between pictures of the sequence.

31. (Currently amended) A method according to <u>Claim 1,</u> <s>any preceding claim</s> further comprising communicating or storing the watermarked picture together with information to assist in identifying the watermark.

32. (Original) A method according to Claim 31, wherein said information comprises a series of local mean values, each mean value corresponding to the local mean of a subset of picture sample values prior to application of a watermark value.

33. (Original) A method according to Claim 32, wherein the information is compressed, preferably JPEG compressed.

34. (Currently amended) A method of testing for the presence of a watermark embedded in a picture signal by a method according to <u>Claim 1,</u> <s>any preceding claim</s>, comprising receiving the picture signal;

correlating the picture signal or a processed signal derived therefrom with a watermark signal;

outputting an estimate of the presence of the watermark based on the results of said correlation.

35. (Original) A method according to Claim 34, including processing the picture signal prior to said correlating to produce said processed signal having an enhanced watermark content.

36. (Original) A method according to Claim 35, wherein processing includes filtering based on received reference picture information.

37. (Original) A method according to Claim 36, wherein the received reference picture information comprises reference local mean values indicative of local mean values of subsets of picture samples in the picture prior to watermarking, or compressed information from which said reference local mean values can be derived.

38. (Original) A method according to Claim 37, wherein processing includes estimating local mean values indicative of local mean values of subsets of picture samples in the picture prior to watermarking.

39. (Currently amended) A method according to Claim 37, or 38 wherein processing includes subtracting the reference or estimated local mean values from local mean values determined for the received picture signal to give a difference signal.

40. (Currently amended) A method according to <u>Claim 37,</u> ~~any of Claims 37 to 39~~ wherein a grid is defined dividing the received signal into regions corresponding to allocation of watermark values, wherein local mean values are determined for each of said regions.

41. (Currently amended) A method according to <u>Claim 34,</u> ~~any of Claims 34 to 40~~ further comprising deriving a series of data values from the received picture signal.

42. (Currently amended) A method according to Claim 39, ~~40 and 41~~ wherein the data sample values are determined based on the sign of the difference signal in regions corresponding to allocation of data values.

43. (Currently amended) A method according to <u>Claim 34,</u> ~~any of Claims 34 to 42~~ wherein said correlating is performed for a plurality of offsets and the offset giving the maximum correlation is determined to give a measure of the position of the watermark within the picture.

44. (Currently amended) A method according to <u>Claim 34,</u> ~~any of Claims 34 to 43~~ wherein correlating is performed taking into account possible effects of picture processing operations, for example rotation, scaling, shifting, cropping or re-sampling operations.

45. (Currently amended) <u>A method of embedding a watermark signal comprising a series of watermark values in a picture signal comprising a series of</u>

<u>picture sample values, the method comprising adjusting picture sample values based on watermark values</u> A method according to any of Claims 1 to 33, wherein the watermark is derived from a combination of a number of substantially independent watermarks or wherein a number of substantially independent watermarks are embedded in each picture.

46. (Original) A method according to Claim 45, wherein said substantially independent watermarks satisfy the following criteria:-

(1) $w^2_1 = \ldots = w^2_N = 1$

(2) $E[w_1] = \ldots = E[w_N] = 0$, where E is the expectation operator

(3) $E[w_k \cdot w_n] = 0$ if $k \neq n$.

47. (Currently amended) A method according to Claim 45 or 46, wherein said number of substantially independent watermarks comprises a subset selected from a defined set of substantially independent watermarks.

48. (Original) A method according to Claim 47, wherein said number is three.

49. (Currently amended) A method according to Claim 47 or 48, wherein there are more than three substantially independent watermarks in said set.

50. (Currently amended) A method according to <u>Claim 45</u> any of Claims 45 to 49, wherein the subset is selected or said substantially independent watermarks are selected in dependence on information to be encoded in the picture.

51. (Currently amended) A method according to <u>Claim 45</u> ~~any of Claims 45 to 50~~, wherein three bipolar watermarks are combined to produce a single bipolar watermark with the property that the product of the combined watermark with each of the constituent marks has an expectation value of ½.

52. (Currently amended) A method according to <u>Claim 34,</u> ~~any of Claims 34 to 44~~ for detecting a watermark embedded by a method <u>wherein the watermark is derived from a combination of a number of substantially independent watermarks or wherein a number of substantially independent watermarks are embedded in each picture</u> ~~according to any of Claims 45 to 51~~, wherein an estimate of the presence of each of said number of substantially independent watermarks is produced.

53. (Currently amended) A method according to Claim 52, <u>wherein said number of substantially independent watermarks comprises a subset selected from a defined set of substantially independent watermarks</u> ~~as dependent on Claim 47~~ wherein the picture is cross correlated with a composite watermark derived from a sum of each of the watermarks of said defined set.

54. (Original) A method according to Claim 53, wherein, at least in the event of cross correlation with said composite watermark yielding a positive result, the picture is cross correlated with each of the watermarks of said defined set.

55. (Currently amended) A method according to Claim 54, <u>wherein the watermark is derived from a combination of three watermarks selected from a defined</u>

set of substantially independent watermarks ~~as dependent on Claim 48~~, wherein the

three watermarks giving the greatest cross-correlation values are identified.

56. (Currently amended) A method according to <u>Claim 34,</u> ~~any of Claims 34~~

~~to 44~~ including estimating the cumulative average motion in a sequence of pictures.

57. (Currently amended) A method according to <u>Claim 34</u> ~~any of Claims 34~~

~~to 44 or Claim 56~~, further comprising computing a motion-compensated average

picture taking into account the average motion in the pictures.

58. (Original) A method according to Claim 57, wherein the watermark is

cross-correlated with the motion-compensated average picture.

59. (Original) A method of detecting a motion-compensated watermark

comprising:

estimating the cumulative average motion in a sequence of pictures;

computing an average picture taking into account the average motion in the

pictures;

calculating the cross-correlation function of the motion-compensated

average picture and the watermark.

60. (Currently amended) A watermarked picture, a sequence of pictures, a

signal or data storage means containing a picture having a watermark embedded

therein by a method according to <u>Claim 1</u> ~~any of Claims 1 to 33 or 45 to 51 or 64 to~~

~~71 or 80 or 81~~.

61. (Currently amended) Apparatus or a computer program product arranged to perform a method according to <u>Claim 1</u> ~~any of Claims 1 to 59 or 62 to 81~~.

62. (Original) A method of decoding data in a picture signal comprising determining local mean values of picture samples corresponding to regions of the picture in which data is carried; comparing said local mean values to estimated or reference local mean values for said regions in the absence of the data, and determining a data value from the result of each comparison, wherein preferably the data value is determined from at least the sign of the difference between the determined local mean value and the estimated or reference local mean value.

63. (Original) A method of embedding data comprising a series of data values in a picture comprising a series of picture values comprising defining a plurality of subsets of the picture values, one subset for each data value, and adding an adjustment factor to each picture value in each subset, a first component, preferably the magnitude, of each adjustment factor being a function of an estimate of the visibility of embedded data at the picture value location and being variable between the picture values of each subset, a second component, preferably the sign, of the adjustment factor being determined by the data value and being substantially constant for the picture values of each subset.

64. (Currently amended) A method <u>of embedding a watermark signal comprising a series of watermark values in a picture signal comprising a series of picture sample values, the method comprising adjusting picture sample values based</u>

on watermark values ~~according to any of Claims 1 to 33 or 45~~ including generating

the watermark by convolving a key with a repeated data sequence to produce a data-

carrying watermark.

65. (Original) A method of generating a watermark encoding data to be

applied to a picture comprising convolving a key comprising a plurality of bits with a

plurality of bits of data.

66. (Currently amended) A method according to claim ~~64 or~~ 65, wherein

each data bit is convolved with substantially an entire key segment having a

predetermined length.

67. (Original) A method according to claim 66, wherein a different key

segment is convolved with each data bit.

68. (Currently amended) A method according to Claim 66 ~~any of Claims 66~~

~~to 67~~, wherein each bit of the watermark is applied to a plurality of bits of the picture,

preferably a block of at least 4 bits of the picture.

69. (Currently amended) A method according to Claim 64, ~~any of Claims 64~~

~~to 68~~ wherein a registration watermark is applied to the picture in addition to the data

carrying watermark, ~~preferably in a method according to any of Claims 45 to 51~~, to

facilitate decoding of data.

70. (Original) A method of embedding a watermark in a moving picture comprising changing the watermark or moving the watermark, preferably substantially randomly, at a shot change, or following detection of an accumulated change in picture content above a predetermined threshold.

71. (Original) A method of embedding a data-carrying watermark in a moving picture comprising changing the data carried by the watermark at a shot change, or following detection of an accumulated change in picture content above a predetermined threshold.

72. (Original) A method of embedding a data-carrying watermark in a moving picture comprising moving the watermark when the data content of the watermark changes, preferably at a shot change or following detection of an accumulated change in picture content above a predetermined threshold.

73. (Original) A method of labelling a frame of a moving picture signal comprising embedding an identifier of at least 64bits into the picture, preferably by a method according to any preceding method claim.

74. (Original) A method according to Claim 73, for use in labelling a broadcast signal or signal to be distributed wherein the identifier encodes at least one of:- the originator of the material, an authorised recipient and a material identifier.

75. (Original) A method according to Claim 73, for use in labelling a source material in a studio, preferably implemented in a camera or recording device, wherein

the identifier includes at least one of:- an identifier of the source of the material,

preferably including at least one of an identifier of a camera, recording time, location,

conditions, and a user-definable label.

76. (Currently amended) A method of decoding a data-carrying watermark

embedded in a picture, by a method according to <u>Claim 64</u> ~~any of Claims 64 to 69~~

comprising:

setting a positional reference, ~~preferably~~ based on the position of a registration

watermark ~~embedded in accordance with Claim 69~~;

estimating watermark values at a plurality of picture locations, preferably by

determining local average values;

based on the estimated watermark values at locations corresponding to each

data bit and a key value corresponding to the location, determining a value for each

data bit.

77. (Original) A method according to Claim 76, wherein watermark values

are determined for a plurality of locations for each data bit and wherein the value for

each data bit is determined by averaging the product of an estimated watermark value

and a key value for each of said plurality of locations.

78. (Original) A method of detecting a watermark in a sequence of moving

pictures comprising determining an expected position of the watermark and thereafter

detecting the watermark based on the expected position, wherein the expected

position is re-determined following a shot change or a change in picture content above

a threshold.

Claim 79 (cancelled).

80. (Original) A method of embedding data in a picture comprising:

generating a data-carrying watermark having a plurality of watermark values by convolving a set of data comprising a plurality of bits of data with a key comprising a plurality of bits;

applying the watermark to the picture by combining each watermark value with a plurality of picture values based on a local estimate of the visibility of the watermark

81. (Original) A method according to Claim 80 for embedding a data stream in a sequence of pictures wherein sets of data are generated at intervals from the data stream and each set is embedded in a plurality of pictures.